Exhibit L

Exhibit E-9

INVALIDITY CONTENTIONS FOR U.S. PATENT NO. 7,177,369
BASED ON DIGITAL BEAMFORMING IN WIRELESS COMMUNICATIONS ("LITVA")

Based upon Plaintiff's Complaint, Infringement Contentions, and apparent claim constructions and application of the claims to Defendant's accused products, as best as they can be deciphered, the reference charted below anticipates or at least renders obvious the asserted claims. These invalidity contentions are not an admission by the Defendant that the accused products are covered by or infringe the asserted claims, particularly when these claims are properly construed and applied. These invalidity contentions are not an admission that the Defendant concedes or acquiesces to any claim construction implied or suggested by Plaintiff's Complaint or Infringement Contentions. Nor is Defendant asserting any claim construction positions through these charts, including whether the preamble is a limitation. The portions of the prior art reference cited below are not exhaustive but are exemplary in nature.

J. Litva et al, "Digital Beamforming in Wireless Communications" ("Litva") was published no later than August 31, 1996. This publication is prior art under at least pre-AIA 35 U.S.C. §§ 102(a), 102(b), and 103(a). As described in the following claim chart, the asserted claims of U.S. Patent No. 7,177,369 (the "'369 Patent"), are invalid as anticipated by Litva.

To the extent that Litva is found not to anticipate one or more of the asserted claims of the '369 Patent, these claims are invalid as obvious in view of Litva alone or in combination with other prior art references disclosed in Defendant's Invalidity Contentions and accompanying charts, including without limitation as set forth below.

'369 Patent	**Litva**
Claim 1	
1[p] A method comprising:	To the extent the preamble is limiting, Litva discloses this claim limitation explicitly, inherently, or as a matter of common sense, or it would have been obvious to add missing aspects of the limitation. For example, see the following passages and/or figures, as well as all related disclosures: :

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
1[a] identifying at least one multipath transmission delay within a reverse path data signal received from a receiving device;	Litva discloses identifying at least one multipath transmission delay within a reverse path data signal received from a receiving device. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
1[b] determining at least one forward path pre-equalization parameter based on said at least one transmission delay; and	Litva discloses determining at least one forward path pre-equalization parameter based on said at least one transmission delay. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary

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	skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
1[c] modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter, where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal.	Litva discloses modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter, where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
2. The method as recited in claim 1, further comprising: receiving said reverse path data signal over at least one reverse transmission path.	Litva discloses receiving said reverse path data signal over at least one reverse transmission path. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the

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	art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
3. The method as recited in claim 2, further comprising: transmitting said modified forward path data signal over at least one forward transmission path.	Litva discloses transmitting said modified forward path data signal over at least one forward transmission path. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
4. The method as recited in claim 1, wherein said reverse path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.	Litva discloses wherein said reverse path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.

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5. The method as recited in claim 1, wherein said modified forward path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.	Litva discloses The method as recited in claim 1, wherein said modified forward path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading.
6. The method as recited in claim 5, wherein said modified forward path data signal includes sub-carrier pre-equalized OFDM data.	Litva discloses wherein said modified forward path data signal includes sub-carrier pre-equalized OFDM data. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading.

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7. The method as recited in claim 6, further comprising: generating corresponding Quadrature Phase Shift Keying (QPSK) modulation values based on said sub-carrier pre-equalized OFDM data.	Litva discloses generating corresponding Quadrature Phase Shift Keying (QPSK) modulation values based on said sub-carrier pre-equalized OFDM data. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
9. The method as recited in claim 1, wherein said reverse path data signal includes identifiable training data.	Litva discloses The method as recited in claim 1, wherein said reverse path data signal includes identifiable training data. For example, see the following passages and/or figures, as well as all related disclosures: Figure 6.1 shows the structure of an element-space digital beamforming network that is used for receiving. As an example, we consider the case where there are L mobile users using the same frequency (or time) channel." "Figure 6.1 The structure of an element-space digital beamforming network used for receiving."

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	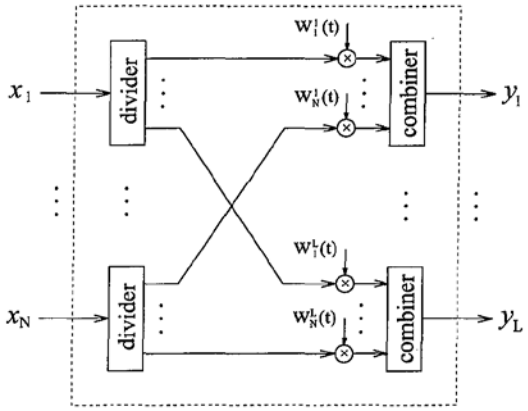 "Figure 6.2 shows the structure of an element-space digital beamforming network that is used for transmitting. The downlink process is almost the reverse of the uplink case. In this case, there are *L* message signals to be transmitted to the *L* mobile users at the same carrier frequency." "Figure 6.2 The structure of an element-space digital beamforming network used for transmitting."

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	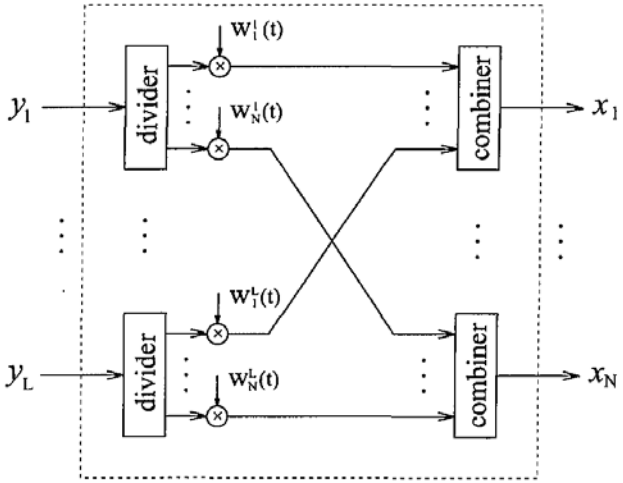 P. 121-122: "The DBF configuration for a basestation system using FDMA in both the uplink and downlink cases is shown in Figures 6.6 and 6.7, respectively, where there are M frequency channels, each of which is used by the system to accommodate L users." "Figure 6.6 Uplink DBF configuration for an FDMA system."

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	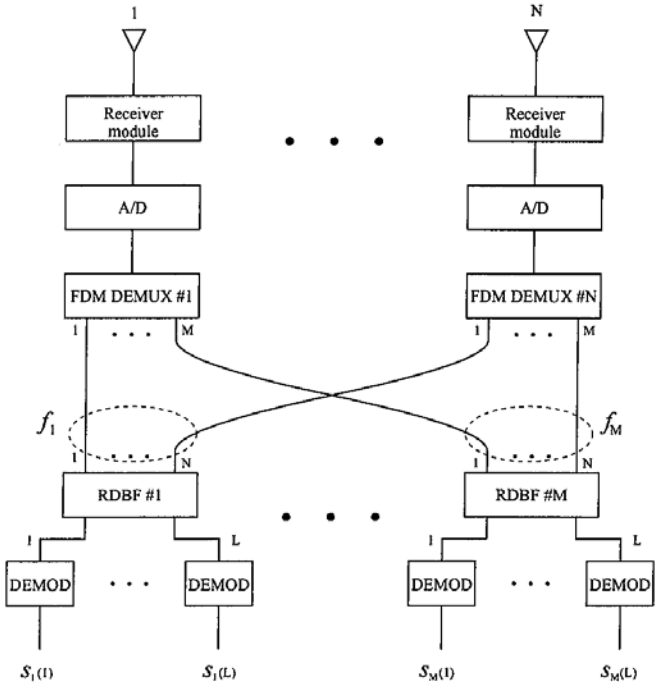 "Figure 6.7 Downlink DBF configuration for an FDMA system."

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	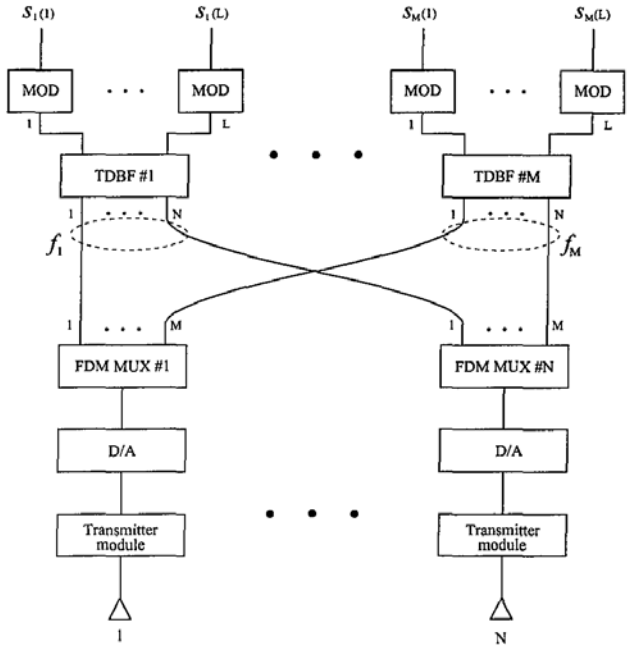 P. 182: Litva notes that "A feedback technique has been suggested by Gerlach and Paulraj [54]" wherein "the basestation transmits probing signals at the downlink frequency" while "normal information transmission is temporally halted" so that "Each mobile in the cell measures its own responses to the probing signals and reports them back to the basestation" and "Based on the reported responses, the downlink channel transfer function is estimated for deriving the downlink weights." One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this

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	element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
10. The method as recited in claim 9, further comprising: comparing said identifiable training data to a local version of said training data to identify said at least one multipath transmission delay within said reverse path data signal.	Litva discloses comparing said identifiable training data to a local version of said training data to identify said at least one multipath transmission delay within said reverse path data signal. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
12. The method as recited in claim 3, wherein said at least one reverse transmission path is substantially reciprocal to said at least one forward transmission path.	Litva discloses wherein said at least one reverse transmission path is substantially reciprocal to said at least one forward transmission path. For example, see the following passages and/or figures, as well as all related disclosures: See discussion of 1[p], 1[a], 1[b] describing that the base station is a transmitting device (e.g., for the downlink OFDM symbols) and that it also determines the pre-equalization parameter and performs the modification of the forward path (downlink) data signal based on the reverse link. Indeed, the '369 acknowledges that reciprocity was already well-known prior to the '369 patent, particularly for TDD channels. See '369 patent at 7:22-34 ("**As is well known**, many materials are electromagnetically isotropic, which is a property resulting from symmetry in their associated

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	permittivity and permeability tensors. The Lorentz Reciprocity Theorem applies to such materials. Refraction and dielectric reflection from materials therefore often show reciprocity, or equivalence of forward and reverse channel characteristics. Diffraction and reflection are inherently reciprocal due to the minimal media affecting the electromagnetic wave. Thus, reciprocity can be used to determine channel characteristics that are used while pre-equalizing a transmitted path. The use of a reciprocal channel is very useful, for example, when Time Division Duplex (TDD) channels are implemented."). One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
13. The method as recited in claim 1, wherein identifying said at least one multipath transmission delay, determining said at least one forward path pre-equalization parameter, and modifying said forward path data signal are performed by a transmitting device.	Litva discloses wherein identifying said at least one multipath transmission delay, determining said at least one forward path pre-equalization parameter, and modifying said forward path data signal are performed by a transmitting device. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.

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14. The method as recited in claim 13, wherein said transmitting device includes a base station device that is operatively configured for use in a wireless communication system.	Litva discloses wherein said transmitting device includes a base station device that is operatively configured for use in a wireless communication system. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
15. The method as recited in claim 13, further comprising: using at least one transmitting device receive antenna operatively coupled to said transmitting device to receive said reverse path data signal over at least one reverse transmission path from the receiving device.	Litva discloses using at least one transmitting device receive antenna operatively coupled to said transmitting device to receive said reverse path data signal over at least one reverse transmission path from the receiving device. For example, see the following passages and/or figures, as well as all related disclosures: As disclosed in the passages below, Litva teaches all of the elements of the '369 patent that recite and/or use antennas including: (1) one or more receive antennas to receive signals on the uplink (reverse path) at base stations; (2) one or more transmit antennas to transmit signals on the downlink (forward) from the base stations; (3) the ability to point the antennas either electronically or mechanically; (4) phased array of antennas; (5) beamforming using the antennas in both the uplink and downlink; and (6) determining the angle of arrival of uplink (reverse path) signals at the base station. *See, e.g.*, p. xi.: "Digital beamforming (DBF) is a technology that has been both spawned and incubated by the sonar and radar communities. It now appears that its ultimate technological home will be in wireless

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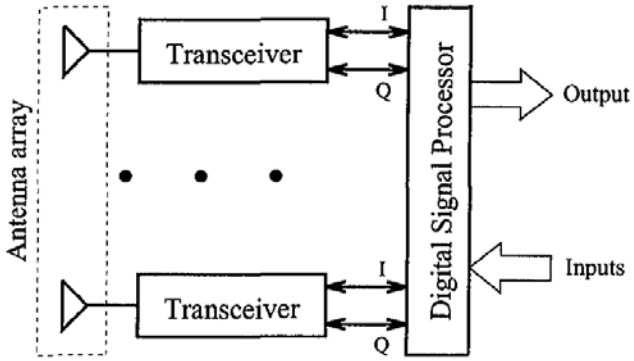
	communications, more specifically, personal communications services, local multipoint distribution systems, and satellite." P. 7: "DBF is a marriage between antenna technology and digital technology. A generic DBF antenna system shown in Figure 1.4 consists of three major components: the antenna array, the digital transceivers, and the digital signal processor." "Figure 1.4 A generic DBF antenna system."  P. 93: "Wireless telecommunications services are provided in different forms. For example, in satellite mobile communications, communications links are provided by the satellite to the mobile users. In land mobile communications, communications channels are provided by the basestations to the mobile users. In PCS, communications are carried out in microcell or picocell environments, including outdoor and indoor." P. 159:

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	"Transmission bit rate can be increased due to the improved SIR at the output of the adaptive beam former." P. 204 "Table 9.3 Characteristics and Parameters of Mobile Data Service Networks (After [13] and [9].)" *See also,* p. xi: "For the most part, even some twenty years ago, workers understood what the processing requirements were to make real-time beamforming a reality." P. 2: "A higher demand in wireless communications calls for higher systems capacities. The capacity of a communications system can be increased directly by enlarging the bandwidth of the existing communications channels or by allocating new frequencies to the service in question. However, since the electromagnetic spectrum is limited, thereby making it a valuable resource, and the electromagnetic environment is increasingly becoming congested with a proliferation of unintentional and intentional sources of interference, it may not be feasible in the future to increase system capacity by opening new spectrum space for the wireless communications applications. Therefore, efficient use of the frequency resource is critical if communications engineers are to increase the capacity of a communications system."

	ARDIS	*MOBITEX*	*CDPD*	*IS-95 Data*	*TETRA*
Frequency (MHz)					
Downlink	800 with	935–940	869–894	869–894	400 & 900 bands
Uplink	45 MHz sep.	896–901	824–849	824–849	400 & 900 bands
Channel spacing	25 kHz	12.5 kHz	30 kHz	1.25 MHz	25 kHz
Channel access	FDMA	FDMA	FDMA	FDMA	FDMA
Multiuser access	DSMA	S-CSMA	S-DSMA/CD	CDMA-SS	DSMA & S-ALOHA
Modulation	FSK, 4-FSK	GMSK	GMSK	4-PSK/DSSS	$\frac{\pi}{4}$-DQPSK
Channel bit rate	19.2 kbps	8.0 kbps	19.2 kbps	9.6 kbps	36 kbps
Spectral efficiency	0.77	0.64	0.64		
Packet length	up to 256 bytes	up to 512 bytes	24–928 bytes		192 & 384 bytes
Carrier	private	private	public	public	public
Service coverage	major metro.	major metro.	all AMPS	all CDMA	trunked radio
Coverage type	indoor/mobile	indoor/mobile	mobile	mobile	mobile

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	P. 3: "There are four domains in which sharing can take place. That is, access can be apportioned to one or more of the following domains: (1) bandwidth, (2) time, (3) code, or (4) space." P. 5: "To maximize the SDMA capacity or the level of frequency reuse, it is desirable to generate a large number of independently steered high-gain mobile spot beams." P. 7: "DBF technology has reached a sufficient level of maturity that it can be applied to communications for improving system performance." P. 9: "[D]igital beamforming allows for a number of attractive features beyond the capabilities of conventional phased arrays: 1. A large number of independently steered high-gain beams can be formed without any resulting degradation in signal-to-noise ratio… system performance can be optimized.... Beams can be assigned to individual users, thereby assuring that all links operate with maximum gain….Adaptive beamforming can be easily implemented to improve the system capacity by suppressing cochannel interference… enhance[d] system immunity to multipath fading…antenna system real-time calibration." P. 9: "Adaptive beamforming technology is also referred to as smart antenna technology in some literature. The use of the term "smart" reflects the antenna's ability to adapt to the environment in which it operates." P. 93: "That is, regardless of their forms, all wireless telecommunications services are subjected to both the influence of the propagation environments and the interference from cochannel signals in a frequency-reuse system." P. 115: "As has been mentioned, the main purpose of carrying beamforming in a communications system is to combat multipath, to extend coverage by the basestation, and/or to reuse frequency channels within a cell." P. 121: "A number of DBF structures have been proposed for satellite communications systems that use FDMA [1-3]. What is common in these systems is that digital beamforming networks have to be placed after the demultiplexers in the uplink case and before the multiplexers in the downlink case." P. 158: "Since then, the concept of using adaptive antennas in land mobile communications has been well received by the communications community, especially in recent years, when PCS has been in its development stage. Many technical papers have been published on adaptive beamforming technology for mobile communications and PCS." P. 158-161: "In particular, a mobile communications system or a PCS system may benefit from the use of adaptive antenna technology in the following aspects…Coverage…Capacity…Signal

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	Quality…Access Technology…Power Control…Handover…Basestation Transmit Power…PoTtable Terminal Transmit Power." P. 158: "Adaptive beamforming can increase the cell coverage range substantially through antenna gain and interference rejection." P. 159: "In general, adaptive beamforming can increase the number of available voice channels through directional communication links. The increase factor depends on the propagation environment, the number of antenna elements, and the amount of DCA allowed by the system. The point is that it is possible to have multiple mobiles on the same RF channel but different spatial channels at a particular cell site." P. 189: "Although adaptive beamforming in both indoor and data communications is similar to that in. mobile communications in many aspects, there are also differences." P. 7: "The early concepts underlying digital beamforming were first developed for applications in sonar [17] and radar systems [18]. DBF represents a quantum step in antenna performance and complexity. It is based on well-established theoretical concepts which are now becoming practically exploitable, largely as a result of recent major advances in areas such as monolithic microwave integrated circuit (MMIC) technology and digital signal processing (DSP) technology." *See, e.g.,* pp. 24-26: Litva teaches that "It is sometimes desirable to form multiple beams that are offset by finite angles from each other" wherein "A multiple-beam beamforming network is known as a beamforming matrix" with "The best known example is given by the Butler matrix [5]" and an example "Butler beamforming matrix for a four-element array is shown in Figure 2.13" wherein "If the elemental spacing is λ /2, the system produces four beams as shown in Figure 2.14".

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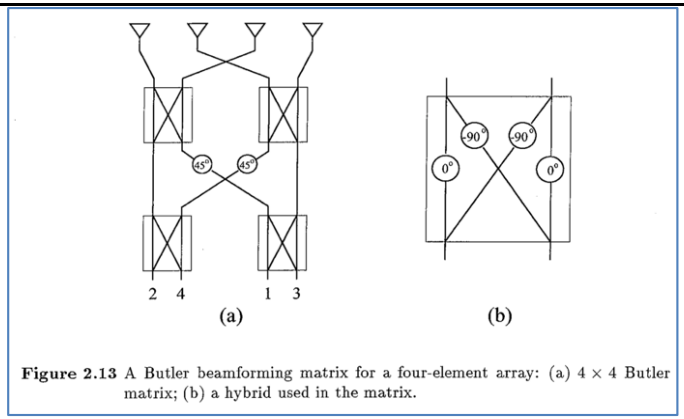
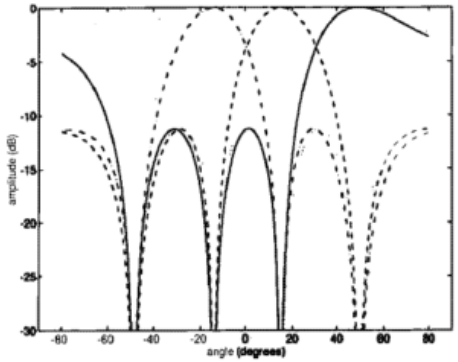
	 **Figure 2.13** A Butler beamforming matrix for a four-element array: (a) 4 × 4 Butler matrix; (b) a hybrid used in the matrix.  **Figure 2.14** Four mutually orthogonal overlapped beams produced by the forming matrix. P. 25: Litva further notes that "Butler matrix beamforming is similar to the fast Fourier transform (FFT) process" but "there is an important difference between them: a Butler matrix processes signals in the analog domain, whereas the FFT processes signals in the digital domain".

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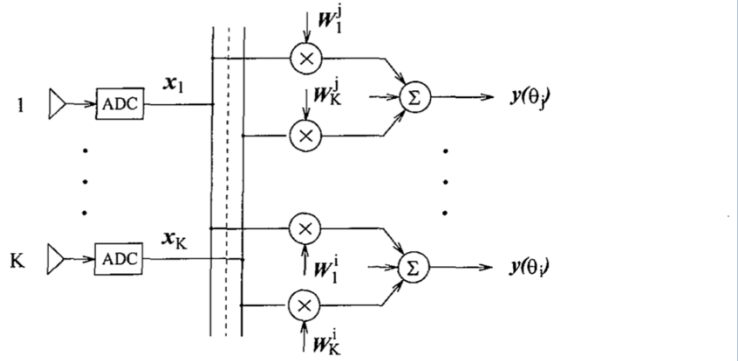
	PP. 30-31: "By multiplying the data signals by different sets of weights, it is possible to form a set of beams with pointing angles directed anywhere in the field defined by the elements used in the array". P. 31: Litva further teaches that "The setup for generating an arbitrary number of simultaneous beams from K antenna elements is shown in Figure 2.17" wherein "By selecting appropriate values for the weighting vectors, one can implement beam steering, adaptive nulling, and beamshaping".  **Figure 2.17** Element-space digital beamformer for simultaneously generating L beams. PP. 31-32: Litva teaches for "Beam-Space Beamforming" that "Rather than directly weighting the outputs from the array elements, they can be first processed by a multiple-beam beamformer to form a suite of orthogonal beams" so that "The output of each beam can then be weighted and the result combined to produce a desired output" and "For example, the beamformer can be implemented by using the FFT" wherein "Figure 2.18 shows the implementation of a weighted FFT-based beamformer".

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	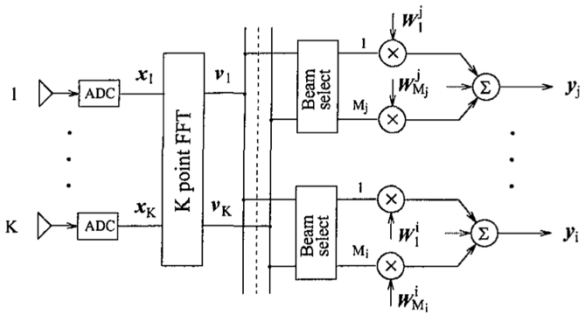 **Figure 2.18** Beam-space digital beamformer for simultaneously generating multiple beams. PP. 36-37: Litva teaches that "The procedure used for steering and modifying an array's beam pattern in order to enhance the reception of a desired signal, while simultaneously suppressing interfering signals through complex weight selection, is illustrated" with respect to "the array shown in Figure 3.1, which consists of two omni-directional antennas with $\frac{\lambda_0}{2}$ spacing" wherein "The desired signal, $S(t)$, arrives from the boresight direction $(\theta_S = 0)$, and the interference signal, $I(t)$, arrives from the angle $(\theta_I = \pi/6)$ radians" and "Both signals have the same frequency f_0".

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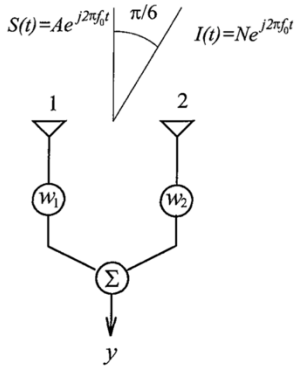

Figure 3.1 Two-element array for interference suppression.

Litva explains in reference to Figure 3.1 that "The signal from each element is multiplied by a variable complex weight, and the weighted signals are then summed to form the array output" so that "The array output due to the desired signal is".

$$y_d(t) = Ae^{j2\pi f_0 t}(w_1 + w_2) \tag{3.1}$$

For $y_d(t)$ to be equal to $S(t)$, it is necessary that

$$\left.\begin{aligned} \Re[w_1] + \Re[w_2] &= 1 \\ \Im[w_1] + \Im[w_2] &= 0 \end{aligned}\right\} \tag{3.2}$$

where $\Re[]$ and $\Im[]$ operate on the real and imaginary values, respectively. The incident interference signal arrives at element 2 with a phase lead with respect to element 1 of value $2\pi\frac{1}{\lambda_0}d\sin(\pi/6) = \pi/2$. Consequently, the array output due to

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	the interference is $$y_I(t) = Ne^{j2\pi f_0 t}w_1 + Ne^{j(2\pi f_0 t+\pi/2)}w_2 \quad (3.3)$$ For the array interference response to be zero, it is necessary that $$\left.\begin{aligned}\Re[w_1] + \Re[jw_2] = 0\\ \Im[w_1] + \Im[jw_2] = 0\end{aligned}\right\} \quad (3.4)$$ Simultaneous solution of (3.2) and (3.4) yields $$w_1 = \frac{1}{2} - j\frac{1}{2}, w_2 = \frac{1}{2} + j\frac{1}{2}$$ With these weights, the array will accept the desired signal while simultaneously rejecting the interference. P. 37: Litva discloses that "this example has demonstrated that a system consisting of an array, which is configured with complex weights, provides countless possibilities for realizing array system objectives" but "We need only develop a practical adaptive processor for carrying out the complex weight adjustment." P. 38: Litva describes that "A generic adaptive beamforming system is shown in Figure 3.2" wherein "The choice of the weight vector **w** is based on the statistics of the signal vector **x(t)** received at the array" such that "the objective is to optimize the beamformer response with respect to a prescribed criterion, so that the output **y(t)** contains minimal contribution from noise and interference."

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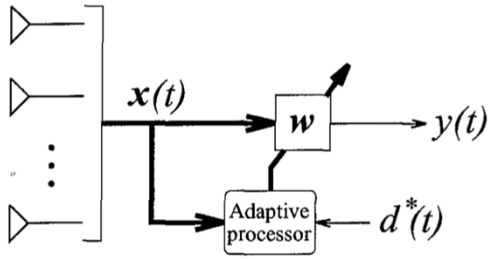

Figure 3.2 A generic adaptive beamforming system.

P. 39. Litva also teaches that "for many applications, characteristics of the desired signal may be known with sufficient detail to generate a signal d*(t) that closely represents it, or at least correlates with the desired signal to a certain extent" wherein "This signal is called a reference signal."

P. 40: More specifically, Litva teaches that "The weights can be chosen to directly maximize the signal-to-interference ratio (SIR)" wherein by solving a "joint eigenproblem" then the:

maximum eigenvalue $\lambda_{\max}$ satisfying

$$\boldsymbol{R}_u^{-1}\boldsymbol{R}_s\boldsymbol{w} = \lambda_{\max}\boldsymbol{w} \qquad (3.20)$$

is the optimum value of (SIR); (i.e., SIR = $\lambda_{\max}$). Corresponding to this value, there is a unique eigenvector, $\boldsymbol{w}_{\text{opt}}$, which represents the optimum weights. There-

PP. 42:
Litva also explains that "the choice of adaptive algorithms for deriving the adaptive weights is highly important in that it determines both the speed of convergence and hardware complexity required to implement the algorithm" and Litva discusses "a number of common adaptive techniques".

P. 51: Litva teaches that "When the number of array elements becomes large" then "full adaptivity may be difficult to implement in practice" because "Exercising a large number of an array's degrees of freedom can result in a considerable level of computational complexity, as well as a decrease in the

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	convergence rate of the adaptive algorithm", thereby leading to "A number of strategies" that "can be used for reducing the degrees of freedom that are presented to the adaptive algorithm, such as:" 1. Judiciously selecting only a fraction of the array elements for adaptive control, thereby carrying out adaptivity at the elemental level [25]; 2. Grouping the entire array into a number of subarrays, carrying out beamforming for each subarray, and adaptively controling the outputs of the subarray beamformers [26]; 3. Forming beams using the entire array and adaptively controling these beams [27, 28]. P. 53: Litva explains that "Adaptive beamforming carried out in beam space is a highly attractive solution to the problem of providing partial adaptivity to an array antenna" but "A partially adaptive beamformer cannot converge to the same optimum solution as the fully adaptive beamformer and will experience a rapid degradation in its performance when the interference scenario calls for more degrees of freedom than available to the adaptive subsystem". P. 93: Litva explains that "The most adverse propagation effect from which wireless communications systems suffer is the multipath fading" which "is usually caused by the destructive superposition of multipath signals reflected from various types of objects in the propagation environments" and "creates errors in digital transmission". PP. 93-94: Additionally, Litva explains that "In a frequency-reuse system, communication signals that are transmitted at the same carrier frequency in different cells are separated by a spatial distance to reduce the level of cochannel interference" but "In order to increase the capacity, additional measures must be taken to combat cochannel interference" such as "optimum combining" wherein "signals from different antenna elements are summed to maximize the signal-to-interference ratio at the output of the combiner" which "is exactly the process of adaptive beamforming." PP. 102-103: Litva also describes "Space Division Multiple Access" (or "SDMA") using "independently steered high-gain beams at the same carrier frequency to provide service to individual

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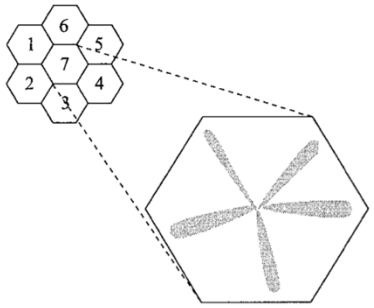
	users within a cell, as shown in Figure 5.8" wherein "Adaptive beamforming can provide such a spatial isolation by pointing a beam at the mobile user and at the same time nulling out the interference from cochannel users".  **Figure 5.8** Adaptive beamforming for SDMA, showing the use of five independently steered beams at the same carrier frequency to provide service to five users within a cell. P. 103: Litva also notes that "Additional system benefits of applying adaptive beamforming at basestations include: 1. improved immunity to multipath fading because of: a. The reduced number of multipath signals, since relatively narrow beams are used; b. Optimal diversity combining that is intrinsically carried out by the beamformer" and "2. The ability to configure the coverage of each basestation to match the local propagation conditions" PP. 116-118: Litva also teaches that "Figure 6.2 shows the structure of an element-space digital beamforming network that is used for transmitting" wherein "L message signals" are "to be transmitted to the L mobile users at the same carrier frequency" such that "L downlink beams are required to be formed simultaneously at this particular frequency"

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	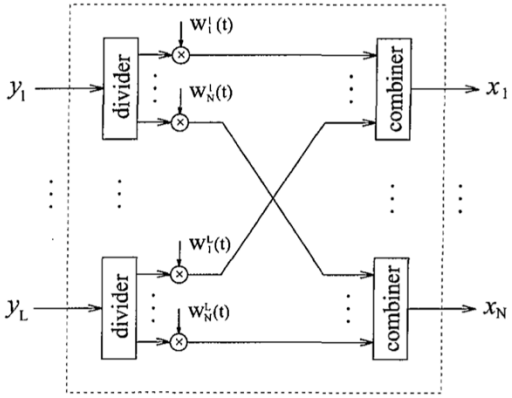 **Figure 6.2** The structure of an element-space digital beamforming network used for transmitting. P. 117: More specifically, Litva explains in reference to Figure 6.2 that "each of the L signals to be transmitted to the users is divided into N branches, which are multiplied by a set of complex weights" representing each "downlink beam to be formed" wherein such "L sets of weights" are "mutually orthogonal" in order to "minimize interference between the L signals that are to be transmitted". PP. 117-119: Litva also teaches that "in order to work with beam-space signals, we need an appropriate transformation between the beam space and the element space" such that "The generation of orthogonal beams can be carried out using a Butler matrix or an FFT, as shown in Figure 6.3"

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	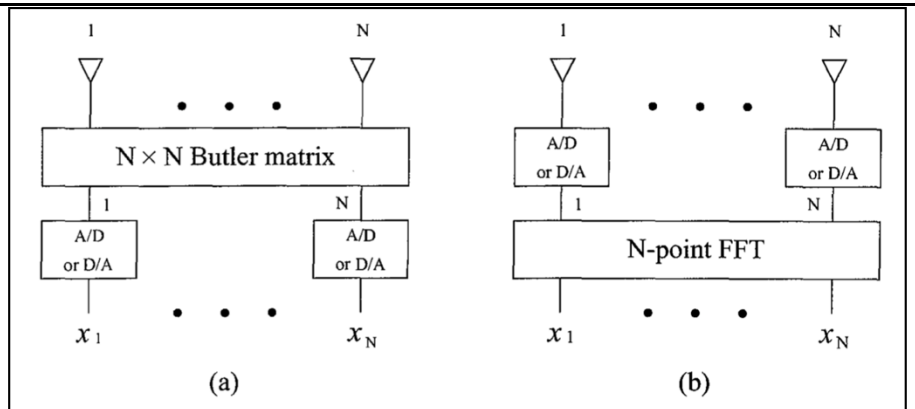 **Figure 6.3** Generation of orthogonal beams for beam-spacing beamforming: (a) analog generation using a Butler matrix; (b) digital generation using an FFT. PP. 119-121: Litva further teaches that "Figure 6.5 shows the structure of a beam-space digital beamforming network that is used for transmitting" wherein "There are L message signals" to be "transmitted at the same carrier frequency" such that "each of the L signals is divided into M branches" so that the "M signals from the l^{th} divider are multiplied by a set of complex weights" and then "assigned to the M desired orthogonal beams by the l^{th} beam-assign circuit"

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	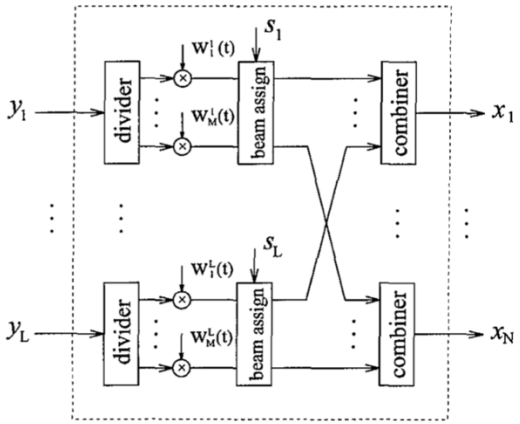 **Figure 6.5** The structure of a beam-space digital beamforming network used for transmitting. PP. 121-123: Litva discloses that "The DBF configuration for a basestation system using FDMA in both the uplink and downlink cases is shown in Figures 6.6 and 6.7, respectively, where there are M frequency channels, each of which is used by the system to accommodate *L* users" wherein "beamforming is applied to the modulated signals from the modulators" so that "The outputs of the beamforming networks are frequency-division multiplexed (FDM) before transmission"

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	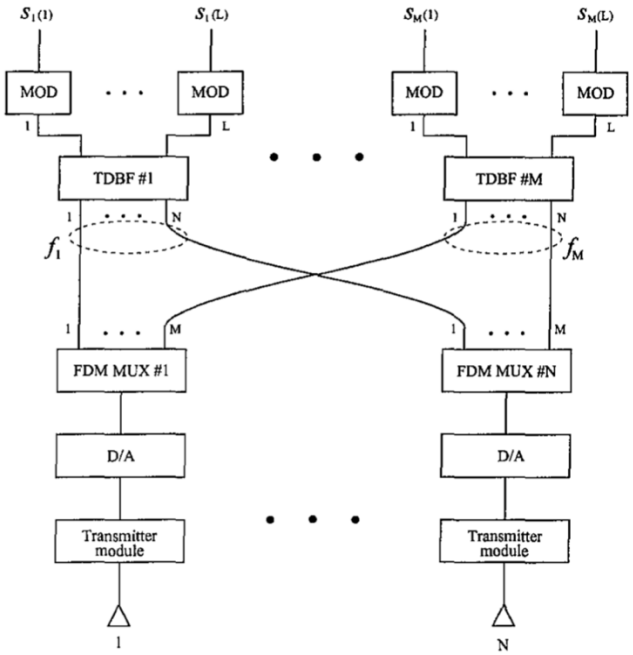 **Figure 6.7** Downlink DBF configuration for an FDMA system. P. 157: Litva explains that "The use of antenna arrays in mobile radio systems to combat cochannel interference was first discussed by Yeh and Reudink in 1980 [4]" where "They showed that with a large number of antenna elements, it was possible to carry out frequency reuse to achieve a very high frequency spectrum efficiency". PP. 157-158: Additionally, Litva explains that "In his classic paper [8], which may arguably be viewed as a milestone in this particular technical field, Winters presented an in-depth study of optimum signal combining for space diversity reception in cellular mobile radio systems" wherein "the signals received

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	by the antennas are so weighted and combined that the signal-to-interference-plus-noise ratio (SINR) of the output is maximized, thereby reducing both the effects of Rayleigh fading of the desired signal and the cochannel interference". P. 158: Litva notes that "optimum combining is also called adaptive beamforming, especially in the antenna community" and one can "use both terms interchangeably" and further that "The results that Winters obtained show that optimum combining is significantly better than maximum ratio combining even when the number of cochannel interferers is greater than the number of antenna elements". PP. 158-159: Litva also discloses "specific benefits of using adaptive antennas in mobile communications" including that "Adaptive beamforming can increase the cell coverage range substantially through antenna gain and interference rejection", "Transmission bit rate can be increased due to the improved SIR at the output of the adaptive beamformer", and "Adaptive antennas can be considered as spatial equalizers and can provide substantial signal quality improvements through spatial signal processing" P. 182: Litva explains that "the objective of adaptive beamforming for uplink is to maximize the SINR of the received desired signal" wherein "In the downlink or forward link (basestation to mobiles) case, the objective remains the same, although the means to achieve it may be different" such that when "using the adaptive antennas, one has both to maximize the received signal strength at the desired mobile and to minimize the interference to other mobiles and adjacent basestations, thereby maximizing the downlink SINR." Litva teaches that "If the transfer function of the channel at the downlink frequency is known, the downlink SINR can be maximized by multiplying the desired signal with a set of downlink weights" and thus "The essence of the problem in downlink beamforming is how to estimate the channel transfer function." P. 266. "**Figure 12.1** Architecture of general purpose digital signal processor."

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	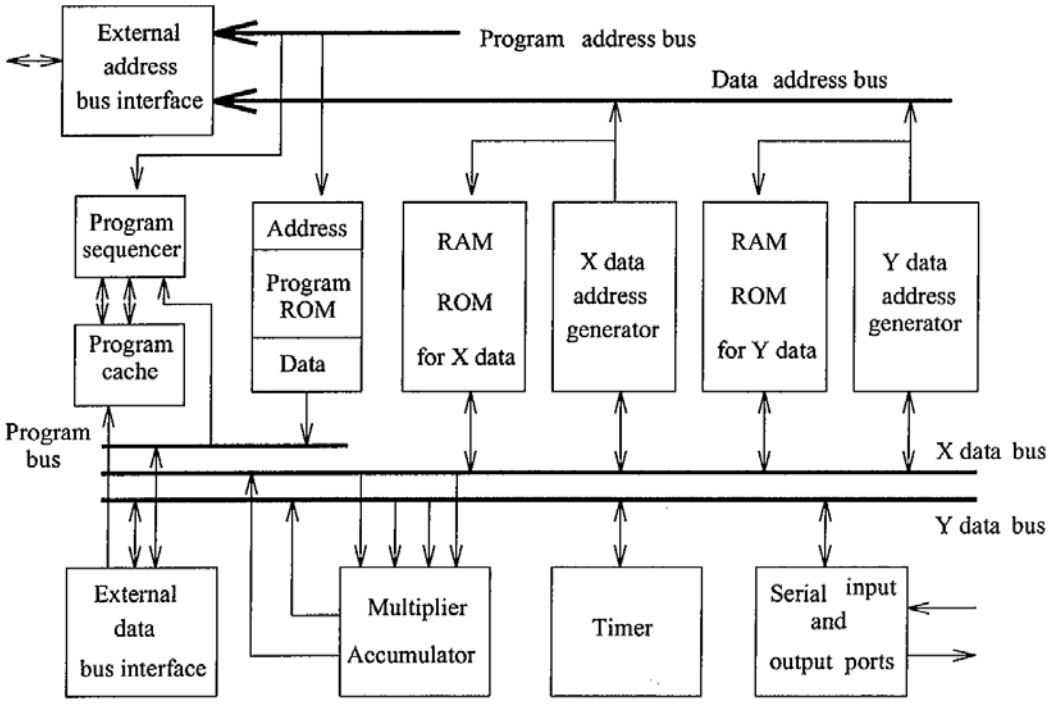 P. 270: "In addition, special purpose DSP processors have many architectural features that differ from those of a general purpose DSP. For instance, bus structures may not be, i.e. they may consist of many multiple and non-uniform buses; memories may have multiple ports and may not conform to standard sizes." P. 204: "In the ARDIS network, the basestation transmitters are shut off temporarily to deal with interference between adjacent basestations, thereby decreasing the capacity of the network. Alternatively, the interference problem between adjacent basestations can be overcome by using adaptive antennas in the basestations. The adaptive antenna used in a basestation steers nulls, for both

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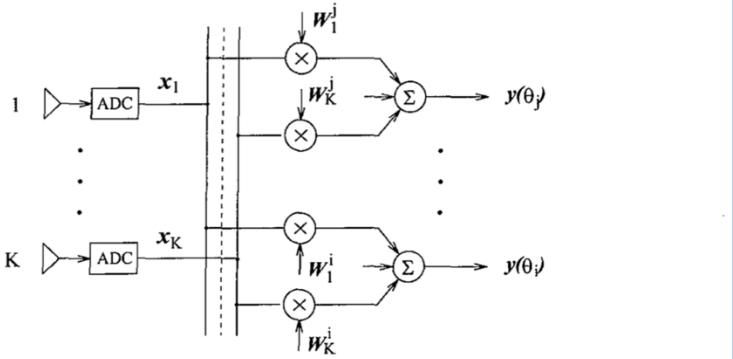
	reception and transmission, in the direction of the adjacent basestations, thereby protecting the basestation against being interfered with by others and preventing from interfering with others. This is accomplished without shutting down the basestations and therefore increases the capacity." P. 182: "As we mentioned earlier, the objective of adaptive beamforming for uplink is to maximize the SINR of the received desired signal. In the downlink or forward link (basestation to mobiles) case, the objective remains the same, although the means to achieve it may be different. That is, using the adaptive antennas, one has both to maximize the received signal strength at the desired mobile and to minimize the interference to other mobiles and adjacent basestations, thereby maximizing the downlink SINR." P. 31: "The setup for generating an arbitrary number of simultaneous beams from K antenna elements is shown in Figure 2.17. By selecting appropriate values for the weighting vectors, one can implement beam steering, adaptive nulling, and beamshaping."  **Figure 2.17** Element-space digital beamformer for simultaneously generating L beams.

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
19. The method as recited in claim 15, wherein said transmitting device is operatively coupled to a plurality of first device receive antennas.	Litva discloses wherein said transmitting device is operatively coupled to a plurality of first device receive antennas. For example, see the following passages and/or figures, as well as all related disclosures: See the citations and discussions for claim 15. As disclosed in the passages below, Litva teaches all of the elements of the '369 patent that recite and/or use antennas including: (1) one or more receive antennas to receive signals on the uplink (reverse path) at base stations; (2) one or more transmit antennas to transmit signals on the downlink (forward) from the base stations; (3) the ability to point the antennas either electronically or mechanically; (4) phased array of antennas; (5) beamforming using the antennas in both the uplink and downlink; and (6) determining the angle of arrival of uplink (reverse path) signals at the base station. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.

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21. The method as recited in claim 15, wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: determining at least one angle of arrival of said reverse path data signal with respect to said at least one transmitting device receive antenna.	Litva discloses wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: determining at least one angle of arrival of said reverse path data signal with respect to said at least one transmitting device receive antenna. For example, see the following passages and/or figures, as well as all related disclosures: See the citations and discussions for claim 15. As disclosed in the passages below, Litva teaches all of the elements of the '369 patent that recite and/or use antennas including: (1) one or more receive antennas to receive signals on the uplink (reverse path) at base stations; (2) one or more transmit antennas to transmit signals on the downlink (forward) from the base stations; (3) the ability to point the antennas either electronically or mechanically; (4) phased array of antennas; (5) beamforming using the antennas in both the uplink and downlink; and (6) determining the angle of arrival of uplink (reverse path) signals at the base station. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
28. The method as recited in claim 13, further comprising: using at least one transmitting device transmit antenna operatively coupled to said transmitting device to	Litva discloses using at least one transmitting device transmit antenna operatively coupled to said transmitting device to transmit said modified forward path data signal over at least one forward transmission path to the receiving device. For example, see the following passages and/or figures, as well as all related disclosures: See the citations and discussions for claim 15.

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transmit said modified forward path data signal over at least one forward transmission path to the receiving device.	As disclosed in the passages below, Litva teaches all of the elements of the '369 patent that recite and/or use antennas including: (1) one or more receive antennas to receive signals on the uplink (reverse path) at base stations; (2) one or more transmit antennas to transmit signals on the downlink (forward) from the base stations; (3) the ability to point the antennas either electronically or mechanically; (4) phased array of antennas; (5) beamforming using the antennas in both the uplink and downlink; and (6) determining the angle of arrival of uplink (reverse path) signals at the base station. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
32. The method as recited in claim 28, further comprising: setting at least one antenna pointing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter.	Litva discloses setting at least one antenna pointing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter. For example, see the following passages and/or figures, as well as all related disclosures: See the citations and discussions for claim 15. As disclosed in the passages below, Litva teaches all of the elements of the '369 patent that recite and/or use antennas including: (1) one or more receive antennas to receive signals on the uplink (reverse path) at base stations; (2) one or more transmit antennas to transmit signals on the downlink (forward) from the base stations; (3) the ability to point the antennas either electronically or mechanically; (4) phased array of antennas; (5) beamforming using the antennas in both the uplink and downlink; and (6) determining the angle of arrival of uplink (reverse path) signals at the base station.

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	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
33. The method as recited in claim 28, further comprising: setting at least one phased array antenna transmission directing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter.	Litva discloses setting at least one phased array antenna transmission directing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter. For example, see the following passages and/or figures, as well as all related disclosures: See the citations and discussions for claim 15. As disclosed in the passages below, Litva teaches all of the elements of the '369 patent that recite and/or use antennas including: (1) one or more receive antennas to receive signals on the uplink (reverse path) at base stations; (2) one or more transmit antennas to transmit signals on the downlink (forward) from the base stations; (3) the ability to point the antennas either electronically or mechanically; (4) phased array of antennas; (5) beamforming using the antennas in both the uplink and downlink; and (6) determining the angle of arrival of uplink (reverse path) signals at the base station. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.

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35. The method as recited in claim 28, further comprising: selecting said at least one transmitting device transmit antenna from a plurality of transmitting device transmit antennas that are each operatively coupled to said transmitting device.	Litva discloses selecting said at least one transmitting device transmit antenna from a plurality of transmitting device transmit antennas that are each operatively coupled to said transmitting device. For example, see the following passages and/or figures, as well as all related disclosures: See the citations and discussions for claim 15. As disclosed in the passages below, Litva teaches all of the elements of the '369 patent that recite and/or use antennas including: (1) one or more receive antennas to receive signals on the uplink (reverse path) at base stations; (2) one or more transmit antennas to transmit signals on the downlink (forward) from the base stations; (3) the ability to point the antennas either electronically or mechanically; (4) phased array of antennas; (5) beamforming using the antennas in both the uplink and downlink; and (6) determining the angle of arrival of uplink (reverse path) signals at the base station. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
36. The method as recited in claim 35, further comprising: selectively transmitting a plurality of beams using two or more transmitting device transmit antennas.	Litva discloses selectively transmitting a plurality of beams using two or more transmitting device transmit antennas. For example, see the following passages and/or figures, as well as all related disclosures: See the citations and discussions for claim 15. As disclosed in the passages below, Litva teaches all of the elements of the '369 patent that recite and/or use antennas including: (1) one or more receive antennas to receive signals on the uplink

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	(reverse path) at base stations; (2) one or more transmit antennas to transmit signals on the downlink (forward) from the base stations; (3) the ability to point the antennas either electronically or mechanically; (4) phased array of antennas; (5) beamforming using the antennas in both the uplink and downlink; and (6) determining the angle of arrival of uplink (reverse path) signals at the base station. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
37. The method as recited in claim 36, wherein each of said transmitted plurality of beams is selectively adjusted in phase and amplitude to reduce multipath affects when received by said receiving device.	Litva discloses wherein each of said transmitted plurality of beams is selectively adjusted in phase and amplitude to reduce multipath affects when received by said receiving device. For example, see the following passages and/or figures, as well as all related disclosures: See the citations and discussions for claim 15. As disclosed in the passages below, Litva teaches all of the elements of the '369 patent that recite and/or use antennas including: (1) one or more receive antennas to receive signals on the uplink (reverse path) at base stations; (2) one or more transmit antennas to transmit signals on the downlink (forward) from the base stations; (3) the ability to point the antennas either electronically or mechanically; (4) phased array of antennas; (5) beamforming using the antennas in both the uplink and downlink; and (6) determining the angle of arrival of uplink (reverse path) signals at the base station. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary

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	skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.
41. The method as recited in claim 1, wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: sub-band equalizing said forward path data signal using corresponding frequency domain reverse path data.	Litva discloses wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: sub-band equalizing said forward path data signal using corresponding frequency domain reverse path data. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading.